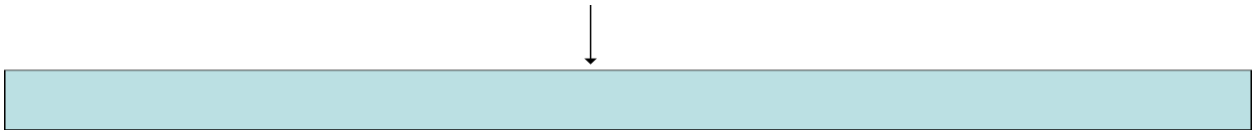
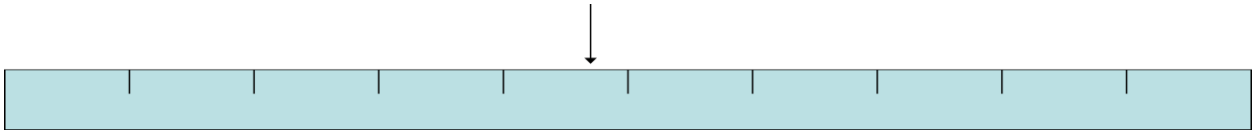
Numbers vs. Measurement

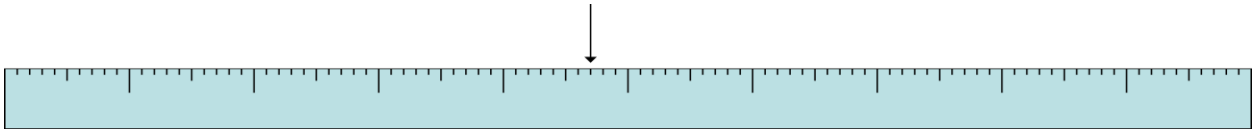
- There is a difference in between _____ used in _____ and _____ used in _____.
- In _____, every _____ carries _____
- In _____, not every number in a _____ carries the same importance.
  - More important numbers are called _____.
  - Less important numbers are called _____.

Measurement

- Every _____ contains an _____amount of _____
  - It includes all _____ that were _____ from the scale used.
  - Plus____ extra '_____' that is not on the scale.
- Always include _____ number than your scale tells you!







Rules for Significant Figures

- There are _____ rules for determining the number of _____
  1. _____rule- (use this rule when the measurement contains a _____)

     -Count the numbers from _____ to _____ beginning at the first _____ number.

0.001234-	12340.-
1.234-	12340.0-
0.123400-	1.2340×10^{-3}-

Rules for Significant Figures

2. _____rule- (use this rule when the measurement does _____contain a _____)

   -Count the numbers from _____ to _____ beginning at the first _____ number.

1234-	12340-
102340-	12340.-

0.123400- 100002-

Scientific Notation

- _____ is a method of writing numbers that:
  - Can make _____ numbers more _____ to read.
  - Indicate the proper number of _____.

Rules for Writing in Scientific Notation

1. Write down all the _____
2. Put a _____ after the first _____. (the number will now be between _____)
3. Write "_____"
4. Write the _____ corresponding to the number of places the _____ was (would have) been moved. (Moving right is _____, moving left is _____)
   - Count the number of digits between where the decimal was before and where it is now

25 000 000 000 000

0.000 000 000 030 0

How do you write the number 10 000 with 3 significant figures?

Change 0.00123×10^{-3} into proper scientific notation.

Calculating using Significant Figures

- There are____ rules for calculating with _____.

1. _____rule- (used for _____ and _____)

   -The answer will have the same _____ as the least _____ measurement from the question.

Calculating using Significant Figures

2. _____rule- (used for _____ and _____)

   -The answer will have the same number of _____ as the least number of _____ from the question.

Science 10

Motion

Units

- A unit is added to every measurement to describe the measurement.

  Ex.
  - 100 cm describes a measured length.
  - 65 L describes a measured volume.
  - 12.4 hours describes a measured time.
  - 0.011 kg describes a measured mass.

Units

- In Canada we use the metric (SI) system.
- The metric (SI) is a system designed to keep numbers small by converting to similar units by factors of 10.
- Prefixes are added in front of a base unit to describe how many factors of 10 the unit has changed.

Units

- Base units of measurement are generally described by one letter.
  - m- metre (length)
  - s- second (time)
  - g- gram (mass) *The base unit for mass is actually the kg (kilogram)
  - L- litre (volume)

Units

- Prefixes

Kilo (k)	hecto (h)	deca (da)	base	deci (d)	centi (c)	milli (m)

- Prefixes are added to the front of any base unit.

  Ex. mm, cm, dm, m, dam, hm, km

Converting units

- There are 2 methods to convert units
  1. Step Method- count the number of places to move the decimal.
  2. Dimensional Analysis- multiplication by equivalent fractions of 1.

Converting Units

- Step method-
  - Move the decimal the same number of spaces and direction as the distance in between prefixes.

Kilo (k)	hecto (h)	deca (da)	base	deci (d)	centi (c)	milli (m)

Ex_1 Convert 34.56 cm into m

Ex_2 Convert 21.0 kg into g

Converting Units

- Dimensional Analysis-
  - Multiply the measurement by a fraction that equals 1
  - The fraction will contain the old unit and the new unit.
  - The fraction must cancel out the old unit. (follow the rule that tops and bottoms cancel out)

Kilo (k)	hecto (h)	deca (da)	base	deci (d)	centi (c)	milli (m)

Complete the following examples using dimensional analysis.

Ex_3 Convert 34.56 cm into m.

Ex_4 Convert 21.0 kg into g.

Ex_5 Convert 15.0 m/s into km/h.

Ex_6 Convert 80.0 km/h into m/s.

Defined Equations

- Relationships between variables can be expressed using words, pictures, graphs or mathematical equations.
  - A defined equations is a mathematical expression of the relationship between variables

Ex. Mass and Energy are related by the speed of light

$$E = mc^2$$

Defined Equations

- Defined equations can be manipulated to solve for any of the variables.
  - We use the same principles from math.
- There are 2 rules that must be followed to isolate a variable.
  1. It must be alone
  2. It must be on top (numerator)

Solve $E = mc^2$ for m

m must be isolated

Divide both sides by c^2

$$\frac{E}{c^2} = \frac{mc^2}{c^2}$$

m is already on top so we will not touch m. We have to isolate m by moving c^2 to the other side.

Ex_1 Solve $d = m/v$ for v

v is on the bottom so we need to move v first and then isolate.

1. Multiply by v on both sides
2. Divide by d on both sides

Speed

- The distance travelled divided by the amount of time.
  - How fast something is moving.

$$v = \frac{\Delta d}{\Delta t}$$

- Speed is measured in $\frac{m}{s}$

Speed

- You can look at speed in 3 different ways
  - Average- the speed over the whole trip.
    - Total distance divided by total time.
  - Instantaneous- the speed at one point in the trip.
    - Looking at the speedometer.
  - Constant- the speed remains the same over a period of time.(uniform motion)
    - Cruise control.

Calculations for speed

- Using the formula, v = d/t, we can make some mathematical calculations about speed.
  - Follow the same 3 steps to solve every problem.
    1. Identify your givens and unknowns.
    2. Identify the defined equation and isolate for the unknown variable.
    3. Solve the equation using proper significant figures and units.

A trip to Calgary is 758 km. If you were to complete the trip in 7.25 h, what was you speed?

Givens	Formula	Solve
d= 758 km t= 7.25 h v= ?	$v = \frac{d}{t}$	$v = \frac{758 km}{7.25 h}$ $v = 105 \frac{km}{h}$

What type of speed did we calculate in the previous problem?

Average speed

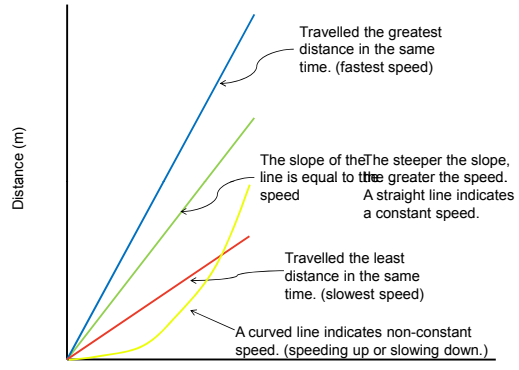
If someone is travelling at a constant speed of 40.0 km/h, how far would they travel in 32.4 min?

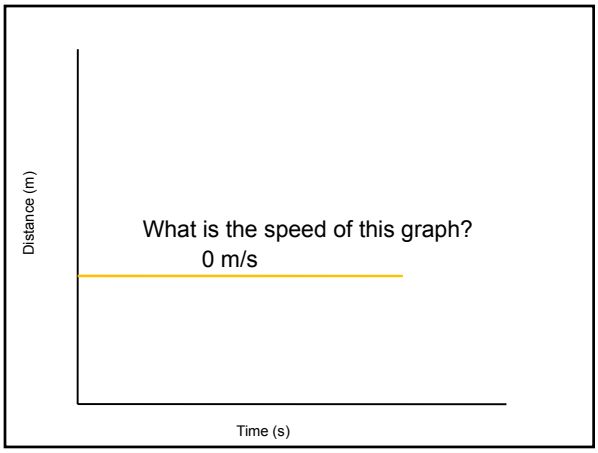
Givens	Formula	Solve
d= ?	$v = \frac{d}{t}$	$d = 40.0\frac{km}{h}(0.54\ h)$
t= 32.4 min	$d = v\,t$	d = 21.6 km
v= 40.0 km/h		

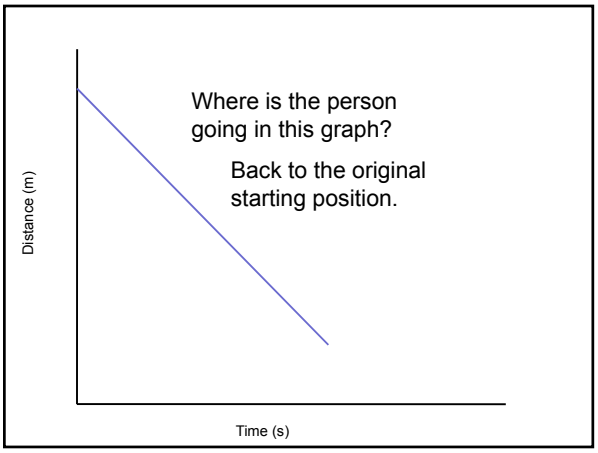
$$32.4\ \text{min} \cdot \frac{1\ h}{60\ \text{min}} = 0.540\ h$$

Representing Speed Graphically

- We can represent speed with words (fast, slow), numbers (32 km/h) and we can also represent it visually with a graph.
  - Speed is represented on a distance vs. time graph.
    - The slope of the graph is the speed.

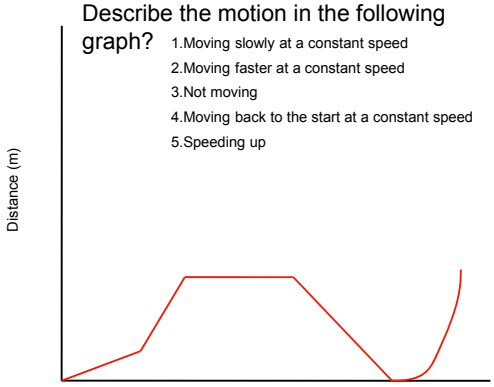






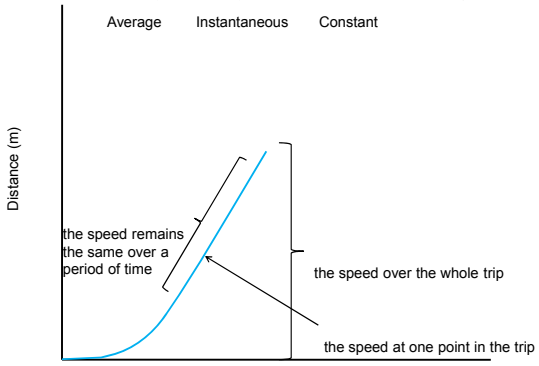
Describe the motion in the following graph?

1. Moving slowly at a constant speed
2. Moving faster at a constant speed
3. Not moving
4. Moving back to the start at a constant speed
5. Speeding up



Identify the 3 types of speed on the graph?

Average Instantaneous Constant



Acceleration

- The change in speed by the amount of time.
  - How quickly something is speeding up (or slowing down)

$$a = \frac{\Delta v}{\Delta t}$$

- Acceleration is measured in $\frac{m}{s^2}$

Acceleration

- You can look at 2 types of acceleration.
  - Average- the acceleration over the whole time period.
    - The change in speed over time.
  - Constant- the acceleration remains the same over a long period of time.

Calculations for acceleration

- Using the formula, $a = \Delta v/\Delta t$, we can make some mathematical calculations about acceleration.
  - 'Δ' means change, Δv means change in speed
  - $\Delta v = v_{final} - v_{initial}$

Or

  - $\Delta v = v_2 - v_1$

A person on their bike changes their speed from 10.0 m/s to 15.0 m/s in 15.2 s. What is the acceleration of the bike?

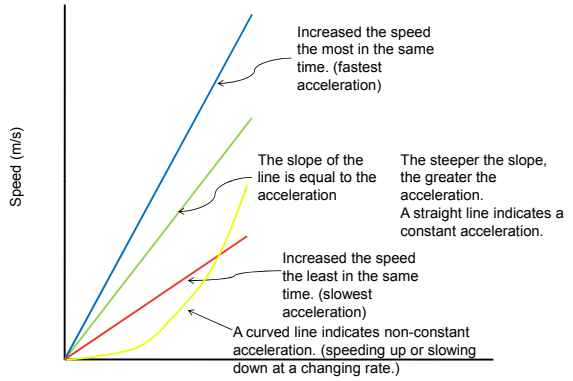
Givens	Formula	Solve
$\Delta v = 15.0\text{m/s} - 10.0\text{m/s} = 5.0\text{ m/s}$ $\Delta t = 15.2\text{ s}$ $a = ?$	$a = \frac{\Delta v}{\Delta t}$	$a = \frac{5.0\text{m/s}}{15.2\text{ s}}$ $a = 0.33\frac{m}{s^2}$

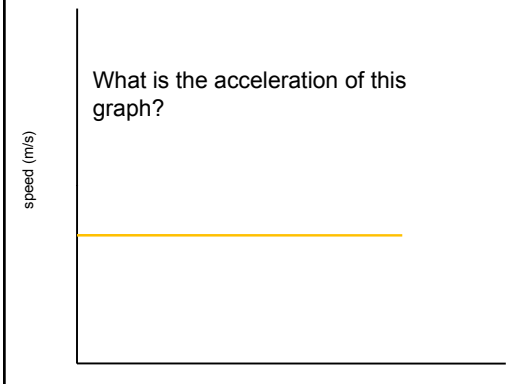
A car is traveling down the road when they see an obstruction. The person accelerates at -3.2 m/s^2 for 5.0 s until they stop. How fast was the car moving?

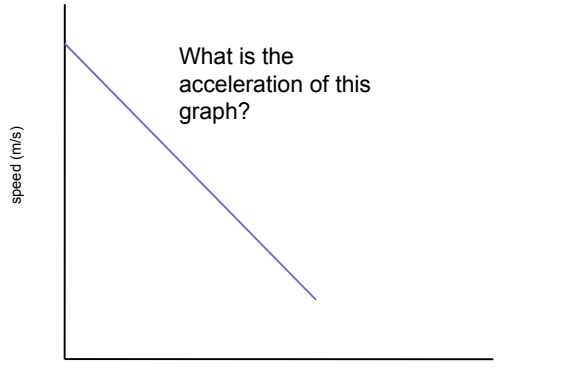
Givens	Formula	Solve
v_1= ?	$a = \frac{v_2 - v_1}{\Delta t}$	v_1=0 m/s –(-3.2m/s^2)5.0s
v_2= 0 m/s		
Δ t= 5.0 s		
a= -3.2 m/s^2	$v_1 = v_2 - a\Delta t$	v_1 = 16 m/s

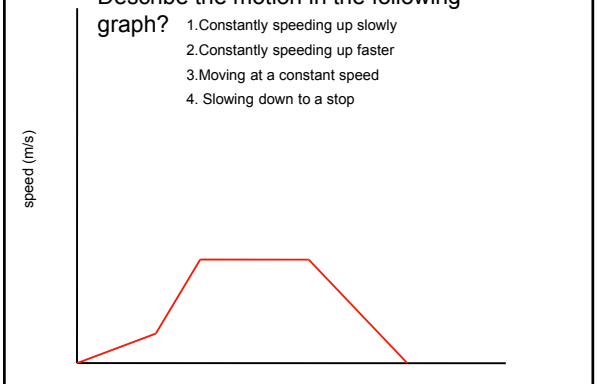
Representing Acceleration Graphically

- We can represent acceleration with words (speeding up, slowing down), numbers (9.8 m/s^2) and we can also represent it visually with a graph.
  - Acceleration is represented on a speed vs. time graph.
    - The slope of the graph is the acceleration.
    - The area under the graph represents the distance travelled

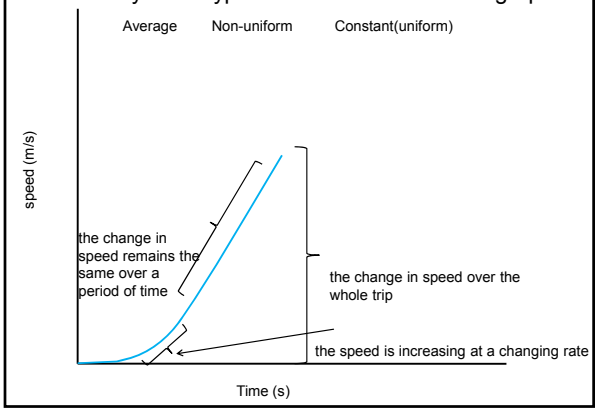




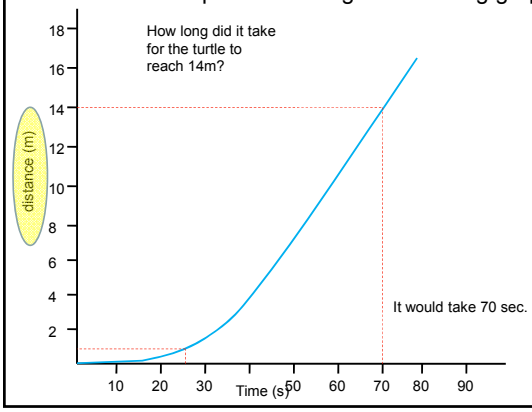




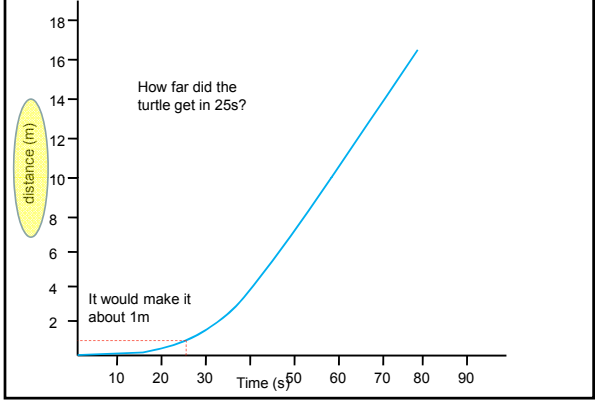
Identify the 3 types of acceleration on the graph?



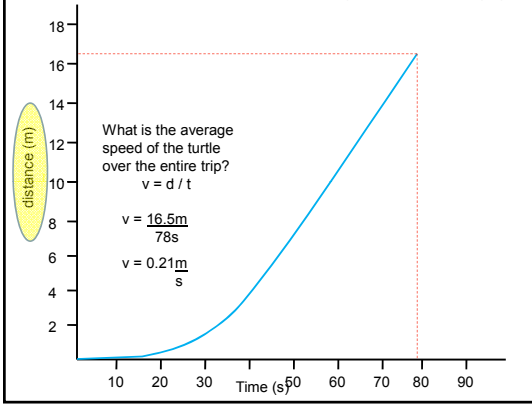
Answer the questions using the following graph.



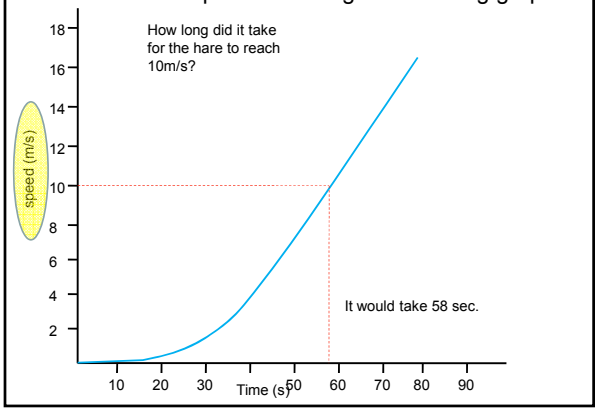
Answer the questions using the following graph.



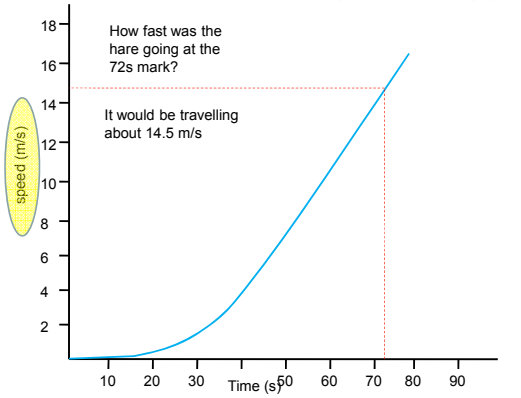
Answer the questions using the following graph.



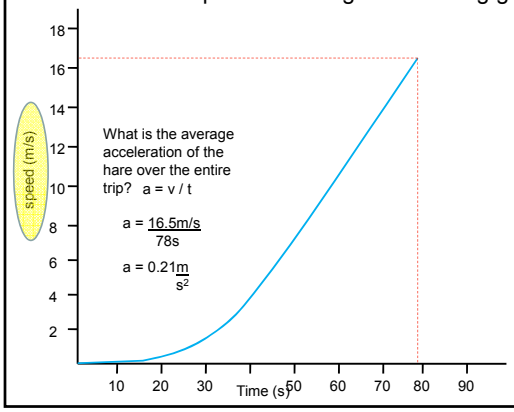
Answer the questions using the following graph.



Answer the questions using the following graph.



Answer the questions using the following graph.

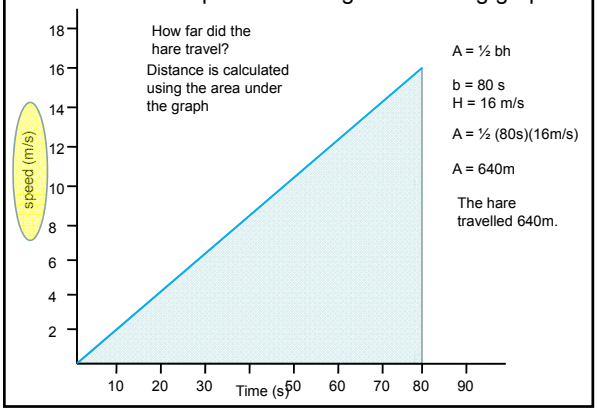


What is the average acceleration of the hare over the entire trip? $a = v / t$

$$a = \frac{16.5 m/s}{78 s}$$

$$a = 0.21 \frac{m}{s^2}$$

Answer the questions using the following graph.



How far did the hare travel?

Distance is calculated using the area under the graph

$A = ½ bh$

$b = 80 s$
$H = 16 m/s$

$A = ½ (80s)(16m/s)$

$A = 640m$

The hare travelled 640m.